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L4: Entry 3 of 35 File: USPT Mar 21, 2000

US-PAT-NO: 6039897
DOCUMENT-IDENTIFIER: US 6039897 A

TITLE: Multiple patterned structures on a single substrate fabricated by elastomeric micro-molding techniques

DATE-ISSUED: March 21, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
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US-CL-CURRENT: 264/1.24; 264/250, 264/259, 264/260, 264/265

CLAIMS:

We claim:
1. A method for patterning a material onto a substrate which comprises the steps of:
a. providing a micro-mold having a plurality of non-communicating, independent channels and having a plurality of reservoirs for receiving a micro-molding fluid each of which reservoirs communicates with a channel, said mold comprising an elastomeric master having a surface with a plurality of recesses therein and a substrate, said mold formed by contacting the surface of said elastomeric master with said substrate such that the recesses in said surface form said plurality of reservoirs and channels;
b. introducing a micro-molding fluid into said mold reservoirs filling said communicating channels; and
c. solidifying said fluid in said mold and removing said elastomeric master thereby generating a pattern of material on said substrate.
2. The method of claim 1 wherein said substrate is a material selected from the group consisting of glass, sapphire, Si/SiO.sub.2, Ti/TiO.sub.2, a metal oxide, a metal nitride, a semiconductor material and a non-reactive metal.
3. The method of claim 1 wherein said molding fluid is a sol.
4. The method of claim 3 wherein said molding fluid is an aqueous sol.
5. The method of claim 3 wherein said sol is an inorganic sol.
6. The method of claim 3 wherein said sol is an organically-modified inorganic sol.
7. The method of claim 3 wherein said sol comprises an indicator dye.
8. The method of claim 3 wherein said sol comprises a biologically active component.
9. The method of claim 1 wherein said patterned substrate comprises independent patterns each comprising different materials formed by introducing two or more different micro-molding fluids into different reservoirs of said micro-mold.
10. The method of claim 9 wherein said micro-molding fluids are sols each of which comprises a different indicator dye.
11. The method of claim 10 wherein said indicator dyes are selected from the group of indicator dyes for pH, Ca.sup.+ or glucose.
12. The method of claim 9 wherein said micro-molding fluids are selected from the group of a prepolymer or monomer solution, an inorganic salt solution, a latex solution, an inorganic sol or an organically-modified inorganic sol.
13. The method of claim 9 wherein one or more of said micro-molding fluids comprises an indicator dye.
14. The method of claim 9 wherein one or more of said micro-molding fluids

comprises a biologically active component.
15. The method of claim 1 wherein said fluid is solidified at a temperature less than or equal to about 100.degree. C.
16. The method of claim 1 wherein said substrate is patterned to comprise an optical waveguide.
17. The method of claim 1 wherein said substrate is patterned to comprise a sensor.
18. The method of claim 1 wherein said substrate to be patterned is within a micro fluid channel.
19. The method of claim 1 further comprising a step of pre-wetting said mold channels prior to introduction of said micro-molding fluid.
20. The method of claim 19 wherein said pre-wetting step is done by dipping said mold in an appropriate solvent.
21. The method of claim 19 wherein said solvent is a lower alcohol.
22. The method of claim 19 wherein said alcohol is ethanol.
23. A method for patterning a substrate which comprises the steps of:
a. providing a micro-mold having a plurality of channels for receiving a micro-molding fluid said mold comprising an elastomeric master having a surface with a plurality of recesses therein and said substrate, said mold formed by contacting the surface of said master with said substrate such that the recesses in said surface form said plurality of channels;
b. introducing a micro-molding fluid which is a sol into said channels; and
c. solidifying said sol in said mold and removing said elastomeric master thereby generating said patterned substrate.
24. The method of claim 23 wherein said sol is an aqueous sol.
25. The method of claim 23 wherein said sol is solidified by gelling and subsequently aged to generate said patterned substrate.
26. The method of claim 23 wherein said sol comprises a precursor of a metal oxide.
27. The method of claim 26 wherein said precursor is an metal alkoxide or mixture of metal alkoxides.
28. The method of claim 27 wherein said precursor is a mixture of alkoxides of different metals.
29. The method of claim 23 wherein said sol comprises an organosilane.
30. The method of claim 29 wherein said organosilane is an alkoxysilane.
31. The method of claim 30 wherein said alkoxysilane is a tetraalkoxysilane.
32. The method of claim 31 wherein said sol further comprises a silane functionalized polymer or prepolymer.
33. The method of claim 32 wherein said silane functionalized polymer or prepolymer is an alkoxysilane.
34. The method of claim 33 wherein said silane functionalized polymer is an N-trialkoxysilylpropyl-O-polyethyleneoxide urethane.
35. The method of claim 23 wherein said sol comprises an indicator dye.
36. The method of claim 35 wherein said indicator dye is a fluorescent dye.
37. The method of claim 23 wherein said sol comprises a biologically active component.
38. The method of claim 37 wherein said biologically active component is selected from the group consisting of proteins, enzymes, antibodies, antigens, nucleic acids, whole cells or cell fractions.
39. The method of claim 23 wherein said patterned substrate is within a micro fluidic channel.
40. The method of claim 39 wherein said patterned substrate provides a plurality of sensing elements within said micro fluidic channel.

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L4: Entry 1 of 35 File: USPT Mar 13, 2001

US-PAT-NO: 6200502
DOCUMENT-IDENTIFIER: US 6200502 B1

TITLE: Process for the production of optical components with coupled optical waveguides and optical components produced by said method

DATE-ISSUED: March 13, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Paatzsch; Thomas	Mainz	N/A	N/A	DEX
Smaglinski; Ingo	Mainz	N/A	N/A	DEX

US-CL-CURRENT: 264/1.25; 205/70, 264/1.27, 264/1.37, 264/1.38, 264/2.5, 430/321

CLAIMS:

What is claimed is:
1. A method for fabrication of components having at least one fiber taper receptacle, comprising the steps of:
A) fabricating a microstructure body comprising the steps of:
1) coating a substrate with a radiation-sensitive material, said radiation-sensitive material having a thickness which decreases continuously in a first direction across at least a transitional region of said radiation-sensitive material;
2) forming a structure, substantially in a shape of a trough which is essentially rectangular in cross section, in said radiation-sensitive substrate coating by a light exposure process, said structure continuously tapering in a second direction across at least a tapering region thereof, said light exposure process conducted so that said tapering region and said transitional region come to overlap;
B) electroforming a form tool by utilizing said microstructure body, said form tool having a surface which is a negative of said microstructure body; and
C) molding an optical component having at least one fiber taper receptacle by utilizing said form tool as a mold.
2. A method according to claim 1, further comprising the step of arranging at least one mask on said coated substrate before said light exposure process, said mask being capable of absorbing energy from said light exposure process, said mask having at least one absorber free region, thus allowing energy from said light exposure process to pass therethrough said absorber free region having a tapering region tapering continuously in a second direction across said tapering region, said mask oriented on said coated substrate such that said first and said second directions are parallel or anti-parallel.
3. A method according to claim 1, wherein the coating is done such that the transitional region of the radiation-sensitive material passes gradually into a second region with constant height.
4. A method according to claim 2, wherein said absorber free tapering region of said mask passes gradually into a second absorber-free region of constant width, provided for a waveguide.
5. A method according to claim 4, wherein said substrate is profiled, and wherein the height profile of the substrate increases essentially continuously in the first direction across at least one region.
6. A method according to claim 1, wherein the coating of the substrate results in the radiation-sensitive material having a flat surface.
7. A method according to claim 1, wherein said radiation-sensitive coating material is an x-ray sensitive resist or a photoresist and said light exposure

L4: Entry 2 of 35 File: USPT Oct 10, 2000

US-PAT-NO: 6129864
DOCUMENT-IDENTIFIER: US 6129864 A

TITLE: Process for producing optical waveguide substrate

DATE-ISSUED: October 10, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Imaeda; Minoru	Nagoya	N/A	N/A	JPX
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US-CL-CURRENT: 264/1.21; 264/1.24, 264/1.7, 264/2.7, 385/131

CLAIMS:

What is claimed is:
1. A process for producing an optical waveguide substrate comprising a ridge-shaped structural portion containing at least an optical waveguide, said process comprising the steps of:
depositing an optical waveguide forming layer, by liquid phase epitaxial growth, on a substrate body to prepare a substrate workpiece;
plane finishing said optical waveguide forming layer by chemical-mechanical polishing to reduce the thickness of said optical waveguide forming layer to about 3 .mu.m-20 .mu.m; and
forming said ridge-shaped structural portion on said substrate workpiece by grinding with a high grade micro-grinder having a diamond abrasive bound thereon by a resin-based binder.
2. The producing process set forth in claim 1, wherein a width of the ridge-shaped structural portion is not less than 3 .mu.m to not more than 20 .mu.m.
3. The producing process set forth in claim 1, wherein when the grinding is to be effected, the micro-grinder is dressed and trued in the state that the micro-grinder is set in a working device.
4. The producing process set forth in claim 1, wherein the substrate body is made of an oxide single crystal.
5. The producing process set forth in claim 4, wherein the oxide single crystal is one or more kinds of single crystals selected from the group consisting of a single crystal of lithium niobate, a single crystal of lithium tantalate and a single crystal of a lithium niobate-lithium tantalate solid solution.
6. The producing process set forth in claim 4, wherein the oxide single crystal is one or more kinds of single crystals selected from the group consisting of a single crystal of potassium lithium niobate and a single crystal of lithium tantalate.
7. The producing process set forth in claim 1, wherein an intermediate layer is formed on the substrate body, and then said optical waveguide-forming layer is formed on the thus formed intermediate layer, the intermediate layer having a refractive index smaller than that of the optical waveguide-forming layer.
8. The producing process set forth in claim 4, wherein an intermediate layer is formed on the substrate body, and then said optical waveguide-forming layer is formed on the thus formed intermediate layer, the intermediate layer having a refractive index smaller than that of the optical waveguide-forming layer.
9. The producing process set forth in claim 5, wherein an intermediate layer is formed on the substrate body, and then said optical waveguide-forming layer is formed on the thus formed intermediate layer, the intermediate layer having a

formed on the thus formed intermediate layer, the intermediate layer having a refractive index smaller than that of the optical waveguide-forming layer.
10. The producing process set forth in claim 6, wherein an intermediate layer is formed on the substrate body, and then said optical waveguide-forming layer is formed on the thus formed intermediate layer, the intermediate layer having a refractive index smaller than that of the optical waveguide-forming layer.